PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Joseph A. FERNANDO, et al.	Docket No.:	UNF.P9058A		
Serial No.	09/560,469	Examiner:	Jennifer A. LEUNG		
Filing Date:	April 28, 2000	Group Art Unit:	1797	Conf. No.:	3786

Title: SUPPORT ELEMENT FOR FRAGILE STRUCTURES SUCH AS CATALYTIC CONVERTERS

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APPELLANTS' BRIEF UNDER 37 C.F.R. § 41.37

To the Honorable Commissioner For Patents:

This is an appeal to the Board of Patent Appeals and Interferences (the "Board") from the final rejection set forth in the Office Action mailed May 19, 2010.

In accordance with 37 C.F.R. § 41.31, Appellants electronically filed the Notice of Appeal via EFS-Web on September 20, 2010, which set the two-month due date for the Appeal Brief on November 20, 2011. 37 C.F.R. §41.37(a). Accordingly, accompanying this submission is a petition and fee for a five month extension which will extend the period to file Appeal Brief until April 20, 2011. 37 C.F.R. §1.136(a).

The present appeal is of pending claims 1, 2, 5-13, 16-27, 41-44 and 47-57.

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1. Real Party in Interest

The owner of the present patent application is Unifrax I LLC, by virtue of an assignment from the Appellants to "Unifrax Corporation" and the subsequent change of name/conversion to a limited liability company from "Unifrax Corporation" to "Unifrax I LLC". Unifrax I LLC is a limited liability company organized under the laws of the state of Delaware, having its principal place of business at 2351 Whirlpool Street Niagara Falls, New York 14305-2413. The assignment for this application from the inventors to Unifrax Corporation was recorded in the records of the Assignment Division of the United States Patent and Trademark Office (the "Office" or "USPTO") on August 7, 2000 at Reel/Frame 011041/0408 and the change of name/conversion to a limited liability company from "Unifrax Corporation" to "Unifrax I LLC" was recorded in the records of the Assignment Division of the USPTO on April 26, 2007 at Reel/Frame 019215/0213.

2. Related Appeals and Interferences

In accordance with 37 C.F.R. § 41.37(c)(1)(ii), Appellants hereby inform the Board of Appeal No. 2005-0979 for Application No. 09/560,469. No other prior pending appeals, interferences, or judicial proceedings are known to Appellants, Appellants' legal representative, or Assignee which may be related to, directly affect or be directly affected by, or have a bearing on the Board's decision in the pending appeal. A copy of the Board's Decision on Appeal No. 2005-0979 is included in the Related Proceedings Appendix.

3. Status of Claims

The present application was filed on April 28, 2000 with original claims 1-40. Claims 41-46 were added by preliminary amendment filed June 5, 2002. Claims 3 and 14 were canceled by Appellants' response mailed August 19, 2005. Claims 4, 15, 28-40, 45 and 46 were canceled and claims 47-57 were added by Appellants' Response mailed April 27, 2006. A Request for Continued Examination for this application was filed with the Office on April 21, 2010. A Final Office Action for this application, subsequent to Appellants' Request for Continued Examination, was mailed by the Office on May 19, 2010.

Claims 1, 2, 5-13, 16-27, 41-44 and 47-57 are currently under final rejection and constitute the claims on appeal.

In accordance with 37 C.F.R. § 41.37(viii), appealed claims 1, 2, 5-13, 16-27, 41-44 and 47-57 appear in the Claim Appendix below.

4. Status of Amendments

A Final Office Action was mailed by the Office on May 19, 2010.

No amendments to pending claims 1, 2, 5-13, 16-27, 41-44 and 47-57 have been filed with the Office subsequent to the mailing date of the Final Office Action.

5. Summary of Claimed Subject Matter

Independent claim 1 is directed to a device for the treatment of automotive exhaust gases comprising a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow; a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing; a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having been prepared by a process including heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å; and wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C. See Specification at Page 7, Line 21 to Page 8, Line 9 and Page 14, Lines 20-23.

Independent claim 12 is directed to a device for the treatment of automotive exhaust gases comprising a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow; a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing; a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having been prepared by a process of heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of greater than 1050°C

for an effective amount of time such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å; wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C. See Specification at Page 7, Line 21 to Page 8, Line 9, Page 14, Lines 20-23 and Page 15, Lines 20-23.

Independent claim 47 is directed to a device for the treatment of automotive exhaust gases comprising a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow; a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing; a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å; and wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C. See Specification at Page 7, Line 21 to Page 8, Line 9 and Page 14, Lines 20-23.

6. Grounds of Rejection to be Reviewed on Appeal

The grounds for rejection to be reviewed in the present appeal are:

A. Rejection Under 35 U.S.C. § 103(a) of Claims 1, 2, 5, 6, 8-13, 16, 17, 19-27, 47-50 and 52-57

The rejection of claims 1, 2, 5, 6, 8-13, 16, 17, 19-27, 47-50 and 52-57 under 35 U.S.C. §103(a) as being unpatentable over Robinson et al. (U.S. Patent No. 5,580,532) in view of Myles (U.S. Patent No. 4,240,833).

B. Rejection Under 35 U.S.C. § 103(a) of Claims 7, 18, 41-44 and 51

The rejection of claims 7, 18, 41-44 and 51 under 35 U.S.C. § 103(a) as being unpatentable over Robinson et al. (U.S. Patent No. 5,580,532) in view of Myles (U.S. Patent No. 4,240,833), as applied to claims 1, 9, 12 and 21, and further in view of Sasaki et al. (JP 07-286514).

7. Argument

Robinson in view of Myles

Claims 1, 2, 5, 6, 8-13, 16, 17, 19-27, 47-50 and 52-57 were rejected as allegedly unpatentable over Robinson et al. (U.S. Patent No. 5,580,532) in view of Myles (U.S. Patent No. 4,240,833). Appellants respectfully traverse.

Claims 1, 12 and 47 recite that the support element comprises an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having been prepared by a process including heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of 990° C to at least 1050° C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å. The support element exerts a minimum residual pressure for holding the fragile structure within the housing of one of at least 4 psi after 200 cycles of testing at 900 C or at least 10 psi after 1000 of testing at 750° C.

The Office alleges that Robinson discloses the claimed apparatus, that is, a device for the treatment of automotive exhaust gases comprising a housing, a fragile structure resiliently mounted within said housing and a support element disposed between the housing and the fragile structure. The Office acknowledges that Robinson is silent as to the support element being made from ceramic fibers having the physical properties of fibers that are formed according to the claimed time-temperature heating regimen. However, the Office alleges that Myles teaches melt-formed and heat-treated microcrystalline ceramic fibers, and that it would have been obvious for one skilled in the art to substitute the fibers of Myles for the fibers of the Robinson apparatus to arrive at the claimed subject matter. Appellants respectfully disagree.

In order to establish a prima *facie case* of obviousness under 35 U.S.C. §103(a) there must be (1) a suggestion or motivation to modify a reference, (2) a reasonable expectation of

success, and (3) the modification of the reference must teach or suggest all claimed limitations. *In re Vaeck*, 947 F.2d 488 (Fed.Cir. 1991). Appellants respectfully submit that the reasons of record in the Final Office Action of May 19, 2010 (hereinafter referred to as "the Final Office Action") fail to establish all three elements of a *prima facie* case of obviousness under 35 U.S.C. §103(a). Because the Final Office Action fails to establish all elements of a *prima facie* case of obviousness under 35 U.S.C. §103(a), the rejection under 35 U.S.C. §103(a) should be withdrawn.

Preliminarily, Appellants note that at page 3 of the Final Office Action, the Office alleges that Appellants' arguments in previous Responses "are against the references individually", and that "one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references." Since it is necessary to argue the appropriateness of the combination of the cited references, Appellants respectfully submit that it is necessary to first point out the teachings of the individual references in order to show their differences as well as their incompatibility.

A. Suggestion or motivation to modify Robinson with the teachings of Myles.

Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so. *In re Kahn*, 441 F.3d 977, 986 (Fed. Cir. 2006).

An example of an invention which was determined to be non-obvious because the prior art failed to provide any teaching, suggestion, or motivation to combine and modify certain features known in the art is set forth in United States v. Adams. The Adams patent was directed to a nonrechargeable electrical battery comprising magnesium and cuprous chloride electrodes placed in a container holding plain or salt water as an electrolyte. The object of Adams was to provide a battery which was able to provide constant voltage and current without the use of acids which were typically used in storage batteries and which did not generate dangerous fumes.

In challenging the validity of the patent, the U.S. government alleged that the Adams patent was obvious in that it was known in the art to substitute magnesium for zinc electrodes and cuprous chloride for silver chloride electrodes and that the Adams battery constituted a mere substitution of these electrodes which were already known in the art. The Supreme Court rejected the government's position.

> Nor is the Government's contention that the electrodes of Adams were mere substitutions of preexisting battery designs supported by the prior art. If the use of magnesium for zinc and cuprous chloride for silver chloride were merely equivalent substitutions, it would follow that the resulting device -- Adams' -- would have equivalent operating characteristics. But it does not. The court below found, and the Government apparently admits, that the Adams battery, 'wholly unexpectedly,' has shown 'certain valuable operating advantages over other batteries,' while those from which it is claimed to have been copied were long ago discarded. Moreover, most of the batteries relied upon by the Government were of a completely different type, designed to give intermittent power and characterized by an absence of internal action when not in use. Some provided current at voltages which declined fairly proportionately with time. Others were so-called standard cells which, though producing a constant voltage, were of use principally for calibration or measurement purposes. Such cells cannot be used as sources of power. For these reasons, we find no equivalency. *U.S. v. Adams*, 383 U.S. 39 (1966).

In upholding Adams, the Supreme Court in *KSR International Co. v. Teleflex Inc.,* 550 U.S. 398, 82 USPQ2d 1385 (2007), provided the following in pertinent part:

> When it first established the requirement of demonstrating a teaching, suggestion, or motivation to combine known elements in order to show that the combination is obvious, the Court of Customs and Patent Appeals captured a helpful insight. See *Application of Bergel,* 48 C.C.P.A. 1102, 292 F.2d 955, 956-957 (1961). As is clear from cases such as *Adams,* a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.

KSR International Co. v. Teleflex Inc., 550 U.S. 398, 82 USPQ2d 1385 (2007).

Hence, because there is no teaching, suggestion or motivation within or which can be deduced from the cited art in the present case to support a prima facie case of obviousness under 35 U.S.C. §103(a), Appellants respectfully submit that the rejection under 35 U.S.C. §103(a) should be reversed.

Appellants claim a support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers prepared by a process which includes heat treating. See Claim Appendix, Claims 1, 12 and 47. Neither Robinson nor Myles provide any teaching, suggestion or motivation for a mounting mat of melt-formed ceramic fibers in a device for treating automotive exhaust gases.

Robinson does not disclose, suggest, or provide motivation to utilize melt-formed ceramic fibers to prepare a support element for an exhaust gas treatment device. Robinson discloses that suitable fibers for use in preparing a mounting mat include polycrystalline ceramic oxide fibers prepared in accordance with United States Patent No. 4,159,205 and United States Patent No. 4,277,269. These references only teach sol-gel processes for preparing polycrystalline ceramic oxide fibers. The disclosed sol-gel processes involve fiberizing fibers from a solution of dissolved ceramic oxide precursor material.

Myles supplies no teaching or suggestion whatsoever that its melt-formed fibers are a functional equivalent to sol-gel fibers, or that the melt-formed fibers could be used to prepare a mounting mat with suitable holding force properties. Myles is directed to refractory ceramic fibers used for insulating high temperature furnaces. See Myles at Col. 1, Lines 10-12. As discussed in further detail below, fibers utilized in exhaust gas treatment devices, such as those disclosed in Robinson, must have the mechanical properties necessary to hold the substrate in position and withstand mechanical impact, vibration and the harsh environments. There is no disclosure in Myles that the furnace insulation was designed to withstand the conditions which fibers of exhaust gas treatment devices are exposed to. Hence, properties such as holding forces

are not even addressed or contemplated by Myles. Therefore, Myles provides no teaching, suggestion or motivation that its fibers are capable of being utilized in exhaust gas treatment devices such as those disclosed in Robinson.

In contrast to the sol-gel processes of Robinson that involve fiberizing solutions of ceramic oxide precursor materials, the fibers utilized in the support element of Appellants' claims 1, 12 and 47 are for use in a device for treating automotive exhaust gases and are prepared by melt-forming processes. Melt-forming involves the melting of solid ceramic oxide precursor material to form a melt of ingredients and forming fibers by a technique, such as blowing, drawing, or spinning. Unlike sol-gel processes, melt-forming processes do not involve dissolving ceramic oxide precursor materials in a solution and then fiberizing the solution.

In view of the above, the <u>only</u> disclosure to use melt-formed and heat-treated ceramic fibers having the presently claimed properties within an exhaust gas treatment device comes from Appellants' Specification. It does not come from the cited references. In fact, in responding to Appellants' position that Myles does not address holding forces, pages 4 and 5 of the Office Action of October 21, 2009 concedes that the combination of melt-formed and heat-treated fibers comes from Appellants' specification.

> This is further evidenced by Applicant's specification, at page 6, lines 12-22, which states that, 'When such fibers are employed, the support mat provides a minimum pressure for holding the fragile catalyst support structure within the housing . . . <u>See Office Action of October 21, 2009, Page 5</u>.

It is the present application, and not the cited art, that provides the teaching that melt-formed and heat-treated fibers can be used in a support element for exhaust gas treatment devices and that these fibers possess the requisite crystallinity, crystallite size and holding pressure values. Therefore, the alleged combination of Robinson and Myles is based on hindsight reconstruction of Appellants claimed subject matter.

The U.S. Supreme Court has stated the following with regard to hindsight, "A fact-finder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning." *KSR International Co. v. Teleflex Inc.,* 127 S.Ct. 1727, 1742 (2007). See Also, *Graham v. John Deere Co of Kansas City,* 383 U.S. 1, 36 (1966) (warning against "temptation to read into the prior art the teaching of the invention in issue" and instructing courts to " 'guard against slipping into the use of hindsight' "), quoting *Monroe Auto Equipment Co. v. Heckethorn Mfg. & Supply Co.,* 332 F.2d 406, 412 (CA6 1964); *In re Fritsch,* 23 USPQ 2d 1780, 1784 (Fed. Cir. 1992)("It is impermissible to use the claimed invention as an instruction manual or a "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious." This court has previously stated that "one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."). Therefore, it is clear that the Office is relying on Appellants' present disclosure to reconstruct the claims in the cited art. The combination Robinson and Myles is based on improper hindsight reasoning and therefore the rejection should be withdrawn.

It is alleged that the fiber composition of Myles is an equivalent structure. <u>See Final Office Action at Page 8</u>. Although structurally similar compositions are presumed to exhibit structurally similar properties (See MPEP §2144.09), this presumption may be rebutted by showing that the claimed composition possesses properties not possessed by those of the prior art or that they possessed them to an unexpectantly greater degree. *In re Dillon*, 919 F.2d 688, 693-694 (Fed. Cir. 1990). In *Ex parte Blattner*, Blattner claimed an azatetracyclic compound useful for treating states of agitation in animals. The Patent Office rejected Blattner's claims based on a structurally similar compound. On Appeal, the Board reversed noting that the compounds of the prior art possessed diametrically opposite utilities in that some of the compounds were used to treat stress and agitation whereas other compounds were used to treat depression. The Board found that this difference undermined the asserted prima facie case for obviousness that structurally similar compounds will have structurally similar properties. The Board further noted that a person of skill in the art who is given only the prior art reference without the benefit of Appellants' disclosure, "would not have had sufficient basis to predict what, if any, utility applicants' azepine compounds might possess." *Ex parte Blattner*, 2 U.S.P.Q. 2d 2047, 2048 (BPAI 1987).

In the case at hand, the fiber insulation composition of Myles is directed solely for use as furnance insulation. See Myles at Col. 1, Lines 10-11 and Col. 6, Lines 4-11. Myles provides no indication that its fiber insulation composition is capable of accommodating the mechanical impact, vibration and the harsh environmental conditions which the mounting mat/support element of Robinson and the present application is designed to withstand, or that a mounting mat having the required minimum holding force could be prepared from the fibers. Without the benefit of Appellants' disclosure, a skilled person would not look to Myles to fabricate a ply or mounting mat for automotive exhaust gas treatment devices. Accordingly, Appellants respectfully request that the 35 U.S.C. §103(a) rejection of claims 1, 12 and 47 over Robinson in view of Myles be withdrawn.

The teachings of Langer and Johnson do not teach or suggest that the melt-formed fibers of Myles are capable of being utilized in the exhaust gas treatment device of Robinson.

The Final Office Action alleges that the use of melt-formed fibers for forming support elements in catalytic converters would have been conventionally known in the art based upon Langer (United States Patent No. 5,250,269). See Final Office Action at Page 4. The Office Action of March 30, 2009 also contends that the prior art to Langer [i.e., Johnson et al. (United Kingdom Patent No. 1,481,133)] further suggests that one of ordinary skill in the art would have considered ceramic fibers which were commonly used in furnace installation to be highly relevant in automotive applications. Appellants respectfully traverse.

Langer discloses ceramic fibers of a fine-grained crystalline structure, or preferably, an amorphous structure. See Langer at Abstract. Likewise, Johnson discloses melt-formed refractory ceramic fibers that can be annealed to develop a fine-grained crystalline form, of less than 200Å, "while avoiding higher temperatures that would result in a course-grained structure ..." See Myles at Col. 1, Line 68 to Col. 2, Line 8 and Johnson at Lines 85-88. Langer discloses annealing fibers below the devitrification temperature of the fiber. See Langer at Col. 2, Lines 56-60. Annealing fibers below the devitrification temperature does not result in the presently claimed crystallite sizes. Unlike Langer and Johnson, Appellants are claiming melt-formed refractory ceramic fibers having a larger grain size. Accordingly, Langer’s disclosed ceramic fibers do not suggest that the presently claimed material would be useful or highly relevant in

automotive applications. Rather, Langer teaches melt-formed fibers that remain fine-grained (as in Johnson) or *substantially amorphous*. See Langer at Col. 2, Lines 56-58. Therefore, although Langer teaches the use of melt-formed ceramic fibers in support elements of catalytic converters, neither Langer nor Johnson provide any teaching or suggestion that melt-formed ceramic fibers having a high degree of crystallinity comparable to that presently claimed may be used in an exhaust gas treatment device. Given that Myles is silent with regard to the crystallinity of its ceramic fibers and that Langer and Johnson only teach or suggest that melt-formed fibers which are substantially amorphous may be utilized in an exhaust gas treatment device, one of skill in the art would not consider the teachings of Langer and/or Johnson in combination with Myles to arrive at the conclusion that the ceramic fibers of Myles may be effectively utilized in the exhaust gas treatment device of Robinson.

There is no suggestion or motivation to add a sacrificial binder to the fibers of Myles in view of the teachings of Robinson and Myles.

Appellants assert that to the extent Myles and Robinson are combinable, there would nevertheless be no motivation to add an exogenous binder to the Myles fiber. This is because Myles teaches a fiber that is sufficiently flexible without the addition of a binder.

> A fiber mat or blanket having a density of about 0.05 to about 0.2 grams per cc and a thickness of about 1 to about 10 centimeters manufactured from fibers in accordance with the present invention, can be used at temperatures as high as 1425°C with less than 2 percent linear shrinkage *yet are sufficiently flexible to be applied to furnace walls without an unacceptable amount of cracking or breaking of the fibers or mats*. See Myles at Col. 4, Lines 2-10.

The Final Office Action, however, alleges that Appellants' claimed feature of a "sacrificial binder" is disclosed in column 5, lines 33-36 and column 6, lines 3-26 of Robinson. See Final Office Action at Page 5. According to the Final Office Action, Robinson teaches the following regarding the binder, "The disclosed binder facilitates the formation of the ceramic fibers into a mat structure, e.g., using conventional paper making techniques, wherein the binder

comprises a sacrificial binder that is burned out of the mounting mat, leaving only the ceramic fibers in the final mounting mat product". See Final Office Action at Page 5. The Final Office Action states that Myles was not relied upon to teach a sacrificial binder. See Final Office Action at Page 5.

According to the Federal Circuit, "A reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect. On the issue of obviousness, the combined teachings of the prior art as a whole must be considered.". *EWP Corp. v. Reliance Universal, Inc.*, 755 F.2d 888, 907(Fed. Cir. 1985) "It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *In re Wesslau*, 353 F.2d 238, 241 (CCPA 1965); *see also Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 448-49 (Fed. Cir. 1986). Likewise, in Bausch & Lomb v. Barnes Hind/Hydorcurve, the Federal Circuit held that the district court, ignored portions of a prior art reference that led away from obviousness by failing to consider that reference in its entirety. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 448-49 (Fed. Cir. 1986).

Although Robinson teaches the application of a binder, Robinson teaches that the binder is used in conjunction with mounting mats composed of polycrystalline ceramic oxide fibers prepared from sol-gel processes. The precise reason to add a sacrificial binder to the support element or the mounting mat is to provide flexibility when handling the support element or mounting mat when wrapping it around a fragile catalyst support structure. Myles, on the other hand, discloses that the mat is flexible enough without binder. Consequently, one having ordinary skill in the art would not be lead to add a sacrificial binder to Myles to impart flexibility when Myles expressly teaches adequate flexibility without binder. The Office simply cannot ignore claimed features or dismiss them as routine design changes when the cited art does not indicate the desirability of such features. Accordingly, Appellants respectfully request that the 35 U.S.C. §103(a) rejection of claims 1, 12 and 47 be withdrawn.

B. There is no reasonable expectation of success based on the combination of Robinson and Myles.

Evidence showing there was no reasonable expectation of success may support a conclusion of nonobviousness. *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976). Whether an art is predictable or whether the proposed modification or combination of the prior art has a reasonable expectation of success is determined at the time the invention was made. *Ex parte Erlich*, 3 USPQ2d 1011 (Bd. Pat. App. & Inter. 1986).

For the combination of Myles and Robinson to have been obvious at the time of the invention, a person of ordinary skill in the art would have needed some reason upon which to base an expectation of success. A reasonable expectation does not exist in this case. Myles is directed to a refractory fiber for use as furnace insulation. A furnace is a static structure that is commonly used in a controlled environment. Myles does not teach that the fiber disclosed is useful in any application other than furnaces, or that the fiber might be used in mechanically demanding environments, such as in automotive exhaust gas treatment devices. Therefore, there is no reasonable basis upon which to base a prediction that use in such application would succeed.

Additionally, Myles does not disclose that the fibers have the mechanical properties needed during normal operation in the environments described in Robinson, namely, catalytic converters and diesel particulate traps. The environments described in Robinson are far more mechanically demanding environments than are furnaces, as the Robinson devices are commonly subject to mechanical impact, vibration, multi-axial loading, and fatigue that would be extremely unusual for furnaces. Accordingly, a person of ordinary skill in the art would not have reason to automatically assume that the fibers of Myles can withstand more demanding mechanical conditions than those for which they were designed or intended.

The dynamic forces to which the devices of Robinson are subjected act intermittently and fluctuate, create many load cycles, and can theoretically induce high-cycle or even very high-cycle fatigue conditions. For example, engine vibrations from an engine averaging 3000 revolutions per

minute at highway speeds of 60 miles per hour over 60,000 miles will induce 180 million (180,000,000) cycles in the vehicle catalytic converter. 180 million loading cycles is very high-cycle fatigue. Appellants contend that no furnace loading pattern could be anticipated to produce such very high-cycle fatigue. Again, one having ordinary skill in the art would have no reason to assume that furnaces or materials for use in furnaces would withstand very high-cycle fatigue loading of such magnitude.

The fibers described in Myles, for use in a furnace, would not need to withstand and could not be predicted to withstand the rate of temperature change or the frequency of temperature change of the devices described in Robinson. At the time of the invention, a person of ordinary skill in the art would have no basis upon which to predict that the fibers described in Myles could successfully withstand the different thermal demands of the devices described in Robinson. Therefore, a person of ordinary skill in the art could not reasonably expect that the fibers of Myles would be capable of adequately functioning as a support element within a device for the treatment of exhaust gases as recited in the present claims.

As mentioned above, Myles is directed for furnaces in a static environment. Consequently, Myles *does not address holding forces.* Therefore, it is not predictable that a melt-formed blanket of Myles would have the adequate holding force as described in Robinson when Myles does not even address holding force issues and the fiber of the Robinson mat is of a different material (i.e., sol-gel fibers). Without any factual substantiation, the Final Office Action presumes that a sol-gel fiber based mounting mat (as described in Robinson) is equivalent to a melt-formed fiber blanket for furnaces (as described in Myles) even though neither reference discloses such a relationship.

For the aforementioned reasons, there can have been no reasonable expectation of success in combining Myles and Robinson at the time the invention was made such that the combination of Myles and Robinson cannot properly support an obviousness rejection. Appellants respectfully request that the obviousness rejection be withdrawn.

C. The combination of Robinson with Myles does not teach or suggest all of the claimed features.

The combination of Robinson with Myles does not arrive at the presently claimed invention because this combination of references does not teach or suggest all of the claimed features, that is, even if Robinson were combined with Myles as proposed, the resultant combination would still fall short of yielding the claimed subject matter and would still fail to satisfy all the claimed features.

As mentioned above, the Office bases its allegation of obviousness on modifying Robinson by substituting the fibers of Myles for the fibers of the Robinson apparatus. This rationale, known as substituting one known element for another, applies when one of ordinary skill in the art is technologically capable of making the substitution and the result obtained from the substitution would have been predictable to one of ordinary skill in the art. See MPEP §2143B. In the case at hand, neither the teachings of Robinson, nor the teachings of Myles provide any indication whatsoever that the claimed combination of physical properties for crystallinity, crystallite size and holding pressure can be obtained by substituting the fibers of Myles for the fibers of the Robinson apparatus. In essence, because the combination of Robinson and Myles fails to provide any teaching or suggestion of a ply of melt-formed ceramic fibers having the claimed physical properties for crystallinity, crystallite size and holding pressure, it would not have been predictable to one of ordinary skill in the art to substitute the fibers of Robinson with the fibers of Myles in order to arrive at the claimed values for crystallinity and crystallite size. Without the claimed crystallinity and crystallite size, there is no expectation that the fibers would provide a mat with sufficient holding pressure.

The Final Office Action identifies certain features of the claimed exhaust gas treatment device which are allegedly disclosed by Robinson, but expressly and unequivocally concedes that Robinson ***does not*** disclose or suggest an exhaust gas treatment device mounting mat (more broadly known as a support element) containing ceramic fibers having the physical properties of fibers that are formed according to the claimed time-temperature heating regimen. See Final Office Action at Page 7. Furthermore, Robinson does not provide any suggestion or motivation to treat the ceramic fibers (for example, by heat treating) to provide such crystallinity and crystallite size. In fact, heat

treating the fibers in the manner presented in claims 1, 12 and 47 is not even contemplated or suggested by Robinson.

Robinson discloses that suitable polycrystalline oxide ceramic fibers and methods of producing the same are found in U.S. Patent Nos. 4,159,205 (Miyahara et al., hereinafter referred to as "Miyahara") and 4,277,269 (Sweeting) which are both incorporated by reference by Robinson. See Robinson at Col. 5, Lines 59-62. The ceramic fibers of Miyahara and Sweeting, however, are not melt-formed as those presently claimed, but rather, are prepared from a solvent solution in a sol-gel process. The disclosed sol-gel processes of Miyahara and Sweeting involve fiberizing fibers from a solution of dissolved ceramic oxide precursor material. The fiberization process of Miyahara and Sweeting comprises spinning a solution of ceramic oxide precursor and heating the fibers in an oxygen atmosphere to form ceramic oxide fibers. See Miyahara at Col. 2, Lines 4-42 and Sweeting at Col. 2, Lines 10-40. Thus, heat is used in Miyahara and Sweeting as a catalyst to form ceramic oxide fibers from the ceramic oxide precursor and not as a separate treatment to ceramic oxide fibers which have already been formed. Accordingly, Miyahara and Sweeting do not provide any teaching or suggestion of using a post-fiberization heat treatment to crystallize the fibers. Hence, the fibers of Robinson are not heat treated to have a crystallite size of greater than 200Å to about 500Å as recited in claims 1, 12 and 47, and Robinson provides no suggestion or motivation for forming fibers having such crystallinity. Because the product of Robinson does not disclose the claimed features of melt-formed ceramic fibers having that claimed percent crystallinity and crystallite size, the product of the instant claims 1, 12 and 47 is not substantially the same as the product of Robinson.

Furthermore, as mentioned above, Myles is directed to furnace insulation in a static environment. Consequently, Myles does not address holding forces, nor does it provide any suggestion or motivation that its fibers are capable of providing the minimal holding force required for holding a fragile structure within a housing of an exhaust gas treatment device. Therefore, even if the fibers of Robinson were substituted with the fibers of Myles, the resultant combination would still fail to teach the minimum residual pressure, as recited in claims 1, 12 and 47, for holding the fragile structure within the housing. Regardless of whether or not it can be said that the claimed fiber composition is structurally similar to the combination of Robinson with Myles, the Federal

Circuit has held that it is permissible to show that similar compounds possess unexpected properties to demonstrate nonobviousness.

> [P]atentability for a chemical compound does not depend only on structural similarity. ...This court will not ignore a relevant property of a compound in the obviousness calculus. …When claimed properties differ from the prior art, those differences, if unexpected and significant, may lead to nonobviousness....One of ordinary skill in the art cannot simply take various components and combine them without a commonality of purpose or characteristics that gives the artisan some reasonable expectation of success. *Eli Lilly & Co. v. Zenith Goldline Pharmaceuticals, Inc.*, 471 F.3d 1369, 1378 (Fed. Cir. 2006).

Therefore, based on the teachings of the cited art, Appellants respectfully submit that it is not predictable that a melt-formed blanket of Myles would have the adequate holding force necessary for the Robinson device when Myles does not even address holding force issues and the fiber of the Robinson mat is of a different material (i.e., sol-gel fibers).

<u>Appellants' claimed values for crystallinity, crystallite size and holding pressure are not inherent or obvious in view of Myles</u>.

The Office Action of June 24, 2008 alleges that the presently claimed holding pressure would be inherent, "because shrinkage is at a minimum, a mounting mat formed from the ceramic fibers of Myles would predictably maintain a stable pressure on the fragile structure within the housing of Robinson." Applicants unequivocally deny that the holding pressure of the currently claimed mounting mat is inherent in the Myles teaching. Resistance to shrinkage is a different and independent property of the material than its ability of provide sufficient holding pressure. The holding pressure of the support element is a result of the heat treatment so that the support element does not experience a permanent compression set.

The Final Office Action alleges that the Myles fibers retain flexibility and show dramatically less shrinkage under high temperatures, and therefore it is alleged that this provides a stable pressure over a wide range of operating temperatures. Resistance to shrinkage is a different and independent

property of the material than its ability of provide sufficient holding pressure. The holding pressure of the support element is a result of the heat treatment so that the element does not experience a permanent compression set. Without acquiescing to the Examiner's position, Applicants submit "that which is inherent in the prior art, if not known at the time of the invention, cannot form a proper basis for rejecting the claimed invention as obvious under §103." See *In re Shetty*, 566 F.2d 81, 86, 195 U.S.P.Q. 753, 756-57 (C.C.P.A. 1977). Obviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established. *In re Rijckaert*, 9 F.2d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993). The fact that a certain result or characteristic <u>may</u> occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Oelrich*, 666 F.2d 578, 581-82, 212 USPQ 323, 326 (CCPA 1981). Because neither of the references teaches or suggests a material that could be formed into a mounting mat and provide the claimed holding pressure, the references do not provide all of the limitations of the claims and therefore do not establish a *prima facie* case of obviousness.

The Office further alleges that the presently claimed crystallinity and crystallite size would be inherent, claiming that because the time-temperature regimen as taught by Myles is identical to or substantially identical to Appellants' claimed time-temperature regimen, a support element comprising the heat treated ceramic fibers of Myles would be identical to the instantly claimed ceramic fibers and have a crystallinity of from about 5 to 50 percent and a crystallite size of greater than 200Å to about 500Å. Appellants deny that the claimed values for percent crystallinity of the currently claimed support element is inherent in the Myles teaching. But that which is inherent in the prior art, if not known at the time of the invention, cannot form a proper basis for rejecting the claimed subject matter as obvious under § 103. *See In re Shetty*, 566 F.2d 81, 86 (CCPA 1977). The combination of the claimed values for crystallinity, crystallite size and holding pressure performance were not known or readily extrapolated from the teachings of the cited art at the time Appellants developed the claimed subject matter renders them unexpected.

The Final Office Action also alleges that the crystallinity and crystallite size would have been considered a result effective variable by one of ordinary skill in the art in view of Myles which teaches general time and temperature parameters for producing a crystalline ceramic fiber and that the discovery of optimum or workable ranges involves only routine skill in the art. <u>See Final Office</u>

Action at Pages 8-9 and Myles at Col. 3, Lines 21-58. Appellants respectfully traverse.

Claims 1, 12 and 47 also recite that the support element exerts a minimum residual pressure for holding the fragile structure within the housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C. Therefore, assuming the Office's premise to be true, one of ordinary skill in the art with knowledge of Myles at the time of the present invention, would also have to discover the optimum or workable ranges for a support element having the claimed values for holding pressure in addition to crystallinity and crystallite size. Considering that Myles is directed solely to furnace insulation wherein holding pressure is not an issue and that Myles provides no teaching or suggestion whatsoever of obtaining a fiber having a particular holding pressure, Appellants respectfully submit that such modifications to Myles would be beyond what would be considered to be routine skill in the art of furnace insulation. Where the prior art has not recognized the "result-effective" capability of a particular invention parameter, no expectation would exist that optimizing the parameter would successfully yield the desired improvement. *In re Antonie*, 559 F.2d 618, 619 (CCPA 1977).

Robinson in view of Myles in further view of Sasaki

Claims 7, 18, 41-44 and 51 are rejected as allegedly unpatentable over Robinson et al. (U.S. Patent No. 5,580,532) in view of Myles (U.S. Patent No. 4,240,833) and further in view of Sasaki et al. (JP 07-286514) under 35 U.S.C. §103(a) as applied to claims 1, 9, 12 and 21. Appellants respectfully traverse. An English language translation of Sasaki is provided with this Appeal Brief in the Evidence Appendix and is referenced to by Appellants.

Claims 7, 18 and 51 recite that the fibers of the support element have less than about 10% shot while claims 41-44 recite that the support element or the mat is needled.

Appellants traversing arguments presented above with respect to the improper combination of Robinson and Myles are not repeated, but are incorporated herein by reference against the rejection of claims 7, 18, 41-44 and 51. Furthermore, Sasaki teaches away from the combination with Myles. Because Sasaki and Myles teach away from one another, the

combination of Myles and Sasaki would not suggest to one of ordinary skill in the art a reasonable expectation of success. Evidence showing there is no reasonable expectation of success may support a conclusion of nonobviousness. *In re Rinehart*, 531 F.2d 1048 (CCPA 1976).

With regard to claims 7, 18 and 51, the Final Office Action alleges that column 5, line 65 to column 6, line 1 of Robinson teaches that the ceramic fibers should be shot free, e.g., on the order of about 5 percent nominally or less. The Final Office Action further alleges that paragraph [0007] of Sasaki teaches a ceramic fiber having a shot content of 5% or less and that it would have been allegedly obvious to create a ceramic fiber having less than about 10% shot because Sasaki teaches that when larger amounts of shot are present in the ceramic fiber, the specific gravity of portions of the support element/mat increases, and thermal conductivity becomes uneven, resulting in an inability to evenly hold the fragile structure. With regard to claims 41-44, the Final Office Action alleges that paragraphs [0008] and [0009] of Sasaki teach that needling orients some of the ceramic fibers in a vertical direction to tightly bind the support element or mounting mat such that the bulk density of the support element or mounting mat is increased and separation or shifting of the layers of the support element or mounting mat can be prevented. Appellants respectfully traverse.

Sasaki discloses a "holder" for exhaust gas purifying devices. The holder is comprised of alumina fibers. The composition of the alumina fibers of Sasaki is strictly limited to fiber compositions having a weight ratio of Al_2O_3:SiO_2 of 70:30 – 74:26. <u>See Sasaki at Abstract (Pages 1 and 2); Claim 1; and Page 4, Lines 3-7</u>. In fact, Sasaki expressly teaches that when the Al_2O_3:SiO_2 ratio is not in the range of 70:30 – 74:26, fiber deterioration occurs prematurely and the fibers do not withstand long usage. <u>See Sasaki at Page 4, Lines 4-7</u>. Sasaki also teaches that when the alumina to silica ratio is not within the above-described range, fiber deterioration caused by crystallization and crystal growth at high temperatures occurs prematurely and it does not withstand long usage. <u>See Sasaki at Paragraph [0005]</u>.

Myles, on the other hand, teaches fibers which are manufactured from a melt containing about 40 to about 65 weight percent alumina and from about 35 to about 60 weight percent silica. <u>See Myles at Col. 2, Lines 36-40</u>. Since the range of weight percent of alumina taught by Sasaki is

70 to 74, and since the range of weight percent of alumina taught by Myles is 40 to 65, the respective ranges of alumina are mutually exclusive. Since the range of weight percent of silica taught by Sasaki is 26 to 30, and since the range of weight percent of silica taught by Myles is 35 to 60, the respective ranges of silica are mutually exclusive.

Sasaki and Myles clearly teach away from one another. The Federal Circuit in *Syntex (U.S.A.) LLC v. Apotex, Inc.*, recited the following as the proper standard for teaching away:

> ...a reference will teach away when it suggests that the developments flowing from its disclosures are unlikely to produce the objective of the applicant's invention. A statement that a particular combination is not a preferred embodiment does not teach away absent clear discouragement of that combination. *Syntex (U.S.A.) LLC v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005).

In this regard, Sasaki teaches that the fiber must be a mullite composition having a weight ratio of alumina to silica of "70/30 ~ 74/26". See Sasaki at Paragraph 5. Sasaki also teaches that when the alumina to silica ratio is not in the above-described range, fiber deterioration caused by crystallization and crystal growth at high temperatures occurs prematurely and it does not withstand long usage. See Sasaki at Paragraph [0005]. Thus, Sasaki clearly discourages the manufacture of a fiber outside its disclosed ratio of alumina to silica. Myles, however, teaches fibers which are manufactured from a melt containing about 40 to about 65 weight percent alumina and from about 35 to about 60 weight percent silica See Myles at Col. 2, Lines 36-40. Given that the range of weight percent of alumina taught by Sasaki is 70 to 74, and given that the range of weight percent of alumina taught by Myles is 40 to 65, the respective ranges of alumina are mutually exclusive. Also, given that the range of weight percent of silica taught by Sasaki is 26 to 30, and given that the range of weight percent of silica taught by Myles is 35 to 60, the respective ranges of silica are mutually exclusive. Myles teaches a fiber comprising a ratio of alumina to silica which is outside the range taught by Sasaki. Sasaki teaches away from the manufacture of the Myles fibers (those outside the range of the ratio of alumina to silica taught by Sasaki) because such fibers would deteriorate due to high crystallization and would not withstand long usage. Thus, no proper obviousness rejection can be made based upon a combination which includes a combination of Sasaki and Myles.

Furthermore, it is impermissible within the framework of 35 U.S.C. §103 to pick and choose from any single reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. *Lubrizol Corp. v. Exxon Corp.,* 896 F. Supp. 302, 322, 7 USPQ2d 1513, 1527 (N.D. Ohio 1988) (It is not permissible to pick and choose only so much of any given reference as will support a given position and ignore the reference in its totality."). In *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.,* the Federal Circuit held that a single line in a prior art reference should not be taken out of context and relied upon with the benefit of hindsight to show obviousness. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.* 796 F.2d 443, 230 USPQ 416 (Fed. Cir. 1986), *cert. denied,* 484 U.S. 823 (1987). Rather, a reference should be considered as a whole, and portions arguing against or teaching away from the claimed invention must be considered. The Office Action simply ignores all of the teachings in Sasaki about fiber composition that would lead one having ordinary skill in the art away from combination with Robinson and Myles, but impermissibly picks and chooses a couple of teachings about shot content and needling to support the rejection. It is not proper to ignore the teachings of Sasaki which would teach against combination with Robinson and Myles and select tangential teachings about shot and needling to support the rejection. Moreover, given the differences in fiber chemistry between Myles and Sasaki, there is no expectation that the teachings about shot content and needling would apply to the fiber compositions of Myles. This is simply conjecture on the part of the Office. In view of the improper combination of Sasaki with Robinson and Myles, Applicants submit that the rejection should be withdrawn.

The Final Office Action alleges that the ceramic fiber composition ratio of Al_2O_3:SiO_2 of 70:30 – 74:26 taught by Sasaki does not teach away from the ceramic fiber compositions taught by Robinson and Myles because Sasaki's ceramic fibers were not produced according to the same time and temperature conditions of Myles. According to the Final Office Action, the disclosed Al_2O_3:SiO_2 ratio of Sasaki may be mandatory according to the teachings of Sasaki, however, such composition ratios may not necessarily be mandatory for ceramic fibers produced according to a different process requiring different time and temperature conditions. Appellants respectfully submit that this position is mere conjecture and does not reflect the teachings of Sasaki. Sasaki provides no teaching or suggestion that altering the time-temperature conditions

of processing the fibers having the disclosed shot content may enable the creation of a fiber having a different composition ratio than that disclosed by Sasaki and that the Sasaki fibers would remain operable for their intended purpose after such modifications. Furthermore, considering that Myles is directed to fibers used for furnace insulation and is not concerned with holding forces (see above), the Office fails to allege what is the specific motivation for one of skill in the art to alter the time-temperature conditions of processing the Sasaki fibers.

Furthermore, Appellants respectfully submit that the prior art, as a whole, must suggest or provide the motivation for deducing the obviousness of the alleged combination. This principle was set forth by the Federal Circuit in *Fromson v. Advance Offset Plate, Inc.* In *Fromson v. Advance Offset Plate*, a series of individual steps known the art for making a photographic plate for photographic printing were combined into a single process. The district court found the process to be obvious in view of the fact that the individual steps were already known in the art and were merely combined to form a single process. The Federal Circuit reversed, stating "[t]he critical inquiry is whether 'there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination.'" *Id.* at 1556 (citation omitted). "Where, as here, nothing of record plainly indicates that it would have been obvious to combine previously separate process steps into one process, it is legal error to conclude that a claim to that process is invalid under § 103." *Fromson v. Advance Offset Plate, Inc.*, 755 F.2d 1549, 1556 (Fed. Cir. 1985).

According to the Court of Customs and Patent Appeals (CCPA) in *In re Dien*, "one cannot fairly infer obviousness from the inadequacies of the prior art." *In re Dien*, 371 F.2d 886, 888 (CCPA 1967). The correct analysis focuses on whether eliminating "those inadequacies by the means disclosed by appellant would have been obvious to one of ordinary skill". According to the CCPA, the issue in *In re Dien* was whether the secondary reference would have made it obvious that substituting "PPA for phosphorus pentoxide would change a generally unsatisfactory process into an excellent one." *Id.* After review of the secondary reference in *In re Dien*, the CCPA found that the reference did not provide the skilled artisan with a reasonable expectation of obtaining appellant's process. The CCPA criticized the reference as overly general and never referring to processes analogous to appellant's and found that the prior art did

not support the alleged combination of references as obvious. *Id.* Likewise, in the present case, there is nothing within Sasaki or Myles which would indicate to a person of ordinary skill in the art that eliminating the inadequate fiber composition ratios of alumina and silica in Sasaki and substituting the shot content of Sasaki into the furnace insulation of Myles would impart certain properties which would render the furnace insulation of Myles capable of functioning as a support element or mounting mat within an exhaust gas treatment device.

The Final Office Action states that Sasaki was merely relied upon to provide additional support to Robinson for maintaining a minimal shot content in ceramic fibers, in order to maintain a uniform thermal conductivity in the support element/mat (with respect to claims 7, 18 and 51), and its general teaching of applying needling to a support element/mat of ceramic fibers, in order to increase its bulk density and to prevent the separation or shifting of layers (with respect to claims 41-44).

However, in determining the differences between the prior art and the claims, the question under 35 U.S.C. §103 is not whether the differences <u>themselves</u> would have been obvious, but whether the claimed invention <u>as a whole</u> would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983) (claims were directed to a vibratory testing machine (a hard-bearing wheel balancer) comprising a holding structure, a base structure, and a supporting means which form "a single integral and gaplessly continuous piece." *Nortron* argued the invention is just making integral what had been made in four bolted pieces, improperly limiting the focus to a structural difference from the prior art and failing to consider the invention as a whole. The prior art perceived a need for mechanisms to dampen resonance, whereas the inventor eliminated the need for dampening via the one-piece gapless support structure. "Because that insight was contrary to the understandings and expectations of the art, the structure effectuating it would not have been obvious to those skilled in the art." 713 F.2d at 785, 218 USPQ at 700 (citations omitted).).

As in *Schenck v. Nortron Corp*, Appellants' insight is contrary to the understanding and expectations of the cited art. As mentioned above, Sasaki is directed to a holder (a.k.a. a support

element or mounting mat) for an exhaust gas purifying device which holds a honeycomb type catalyst in a catalyst casing. <u>See Sasaki at Paragraph [0001]</u>. Sasaki teaches in paragraph [0007] that when the shot content, with 45μm diameter or greater exceeds 5% by weight, the specific gravity of portions of the holder increases causing the thermal conductivity to become uneven and results in a loss of the holder's ability to evenly hold a honeycomb type catalyst. Myles, however, is directed to insulation for high temperature furnaces. As mentioned above, Myles does not teach that its fiber are useful in any application other than furnaces, or that its fibers might be used in mechanically or thermally dynamic environments, such as in automotive exhaust gas treatment devices. Furthermore, Myles does not disclose that the fibers have the mechanical properties needed during normal operation in the environments described in Sasaki as well as Robinson, namely, catalytic converters and diesel particulate traps. Thus, it is unlikely that a person of ordinary skill in the art at the time of the invention would look to Sasaki to deduce any advantages that reducing the shot content of the fibers of Myles may have on improving the holding force of the Myles fibers when used within an exhaust gas treatment device when Myles does not even address support elements or mounting mats for exhaust gas treatement devices. Therefore, there is no reasonable basis upon which to base a prediction that reducing the shot content of the fibers of Myles in such applications would succeed.

<u>Conclusion</u>

For all of the above reasons, Appellants respectfully submit that independent claims 1, 12 and 47 are not taught or suggested by any combination of Robinson and Myles. Appellants submit that, since claims 1, 12 and 47 are not rendered obvious by the combination of Robinson and Myles, for the above reasons, claims 8-9, which depend from claim 1, claims 19-25, which depend from claim 12, and claims 52, 53, 56 and 57, which depend from claim 47 are also non-obvious. *See In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). ("If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious." MPEP § 2143.03 at page 2100-142.) Appellants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 1, 8, 9, 12, 19-25, 47, 52, 53, 56 and 57 be reversed.

Appellants have addressed the instant rejections presented in the Final Office Action with respect to independent claims 1, 12 and 47 in particular, and have distinguished the applied references as discussed above. It is therefore deemed unnecessary to address the Office's specific allegations regarding the dependent claims. Appellants therefore traverse these allegations, and do not concur with the same either explicitly or implicitly by not refuting each individually.

For all of the above reasons, Appellants further respectfully submit that claims 7, 18, 41-44 and 51 are not taught or suggested by any combination of Robinson, Myles and Sasaki. Claims 7 and 41-42 ultimately depend from and incorporate the features of claim 1, claims 18 and 43-44 ultimately depend from and incorporate the features of claim 12, and claim 51 depends from and incorporates the features of claim 47. Because the combination of Robinson and Myles do not teach or suggest the subject matter of claims 1, 12 and 47, Appellants respectfully submit that Robinson and Myles do not teach or suggest the subject matter of claims 7, 18, 41-44 and 51 before one even considers Sasaki. Appellants further submit, based on the reasons set forth above, that even if Sasaki is considered in combination with Robinson and Myles, that the combination still does not teach or suggest the subject matter of claims 7, 18, 41-44 and 51. Appellants therefore respectfully request that the 35 U.S.C. § 103(a) rejection of claims 7, 18, 41-44 and 51 be reversed.

Appellants submit that the remarks presented hereinabove overcome the 35 U.S.C. § 103(a) rejection of all pending claims. Appellants respectfully request that the Board reverse the final rejection of these claims, and to require the Office to issue a formal Notice of Allowability of claims 1, 2, 5-13, 16-27, 41-44 and 47-57 over the art of record.

Respectfully submitted,

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8. Claims Appendix

In accordance with 37 C.F.R. § 41.37 (c)(1)(ix), the claims on appeal are as follows:

1. (Previously Presented) A device for the treatment of automotive exhaust gases comprising:

a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having been prepared by a process including heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å; and

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

2. (Original) The exhaust gas treatment device of claim 1, wherein the fragile structure has a perimeter, at least a portion of which is integrally wrapped by the support element.

3-4. (Cancelled)

5. (Original) The exhaust gas treatment device of claim 1, wherein the fibers have average diameters ranging from about 1 microns to about 14 microns.

6. (Original) The exhaust gas treatment device of claim 5, wherein the fibers have average diameters ranging from about 3 microns to about 6.5 microns.

7. (Original) The exhaust gas treatment device of claim 1, wherein the fibers have less than about 10% shot.

8. (Original) The exhaust gas treatment device of claim 1, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 200 cycles of testing at 900°C of at least 10 psi.

9. (Original) The exhaust gas treatment device of claim 1, wherein the support element is prepared by the process comprising melt spinning the fibers; heat treating the fibers; and incorporating the fibers into mat form.

10. (Original) The exhaust gas treatment device of claim 1, wherein said exhaust gas treatment device is a catalytic converter.

11. (Original) The exhaust gas treatment device of claim 1, wherein said exhaust gas treatment device is a diesel particulate trap.

12. (Previously Presented) A device for the treatment of automotive exhaust gases comprising:

a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight

percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having been prepared by a process of heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of greater than 1050°C for an effective amount of time such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å;

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

13. (Original) The exhaust gas treatment device of claim 12, wherein the fragile structure has a perimeter, at least a portion of which is integrally wrapped by the support element.

14-15. (Cancelled)

16. (Original) The exhaust gas treatment device of claim 12, wherein the fibers have average diameters ranging from about 1 microns to about 14 microns.

17. (Original) The exhaust gas treatment device of claim 16, wherein the fibers have average diameters ranging from about 3 microns to about 6.5 microns.

18. (Original) The exhaust gas treatment device of claim 12, wherein the fibers have less than about 10% shot.

19. (Original) The exhaust gas treatment device of claim 12, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 200 cycles of testing at 900°C of at least 10 psi.

20. (Original) The exhaust gas treatment device of claim 12, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 1000 cycles of testing at 750°C of at least 10 psi.

21. (Original) The exhaust gas treatment device of claim 12, wherein the support element is prepared by the process comprising melt spinning the fibers; heat treating the fibers; and incorporating the fibers into mat form.

22. (Previously Presented) The exhaust gas treatment device of claim 12, wherein the fibers are heat treated under a time-temperature regimen of heat treating at a temperature between 1100°C and about 1400°C for at least 1 hour.

23. (Previously Presented) The exhaust gas treatment device of claim 12, wherein the fibers are heat treated under a time-temperature regimen of heat treating at a temperature of at least 1100°C for at least 2 hours.

24. (Previously Presented) The exhaust gas treatment device of claim 12, wherein the fibers are heat treated under a time-temperature regimen of heat treating at a temperature of at least 1200°C for at least 10 minutes.

25. (Original) The exhaust gas treatment device of claim 22, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 1000 cycles of testing at 750°C of at least 20 psi.

26. (Original) The exhaust gas treatment device of claim 12, wherein said exhaust gas treatment device is a catalytic converter.

27. (Original) The exhaust gas treatment device of claim 12, wherein said exhaust gas treatment device is a diesel particulate trap.

28-40. (Cancelled)

41. (Previously Presented) The exhaust gas treatment device of claim 1, wherein said support element is needled.

42. (Previously Presented) The exhaust gas treatment device of claim 9, wherein said mat is needled.

43. (Previously Presented) The exhaust gas treatment device of claim 12, wherein said support element is needled.

44. (Previously Presented) The exhaust gas treatment device of claim 21, wherein said mat is needled.

45-46. (Cancelled)

47. (Previously Presented) A device for the treatment of automotive exhaust gases comprising:

a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers comprising about 40 weight percent to about 60 weight percent alumina and about 60 weight percent to about 40 weight percent silica, and a sacrificial binder, wherein said fibers having about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of greater than 200Å to about 500Å; and

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

48. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the fragile structure has a perimeter, at least a portion of which is integrally wrapped by the support element.

49. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the fibers have average diameters ranging from about 1 microns to about 14 microns.

50. (Previously Presented) The exhaust gas treatment device of claim 49, wherein the fibers have average diameters ranging from about 3 microns to about 6.5 microns.

51. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the fibers have less than about 10% shot.

52. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 200 cycles of testing at 900°C of at least 10 psi.

53. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the support element is prepared by the process comprising melt spinning the fibers; heat treating the fibers; and incorporating the fibers into mat form.

54. (Previously Presented) The exhaust gas treatment device of claim 47, wherein said exhaust gas treatment device is a catalytic converter.

55. (Previously Presented) The exhaust gas treatment device of claim 47, wherein said exhaust gas treatment device is a diesel particulate trap.

56. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 1000 cycles of testing at 750°C of at least 10 psi.

57. (Previously Presented) The exhaust gas treatment device of claim 47, wherein the support element provides a minimum residual pressure for holding the fragile structure within the housing after 1000 cycles of testing at 750°C of at least 20 psi.

9. Evidence Appendix

[Translator note "TN": A word in brackets is added by the translator in order to make the meaning clear.]

(19) Japanese Patent Office (JP)

Kokai Tokkyo Koho (A) **No. 7-286514**
(Publication of Unexamined Patent Application)

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[TN: A word with an asterisk can be read differently due to nature of Japanese.]

(54) **[Title of the invention]** Holder for exhaust gas purifying device

(57) **Abstract**

[Constitution]

A holder for an exhaust gas purifying device characterized by a constitution comprised of a blanket made by: laminating alumina fiber, for which the single fiber tensile strength is 150~400kg/mm^2, 5% by weight or less of shot content having a 45μm diameter or greater,

and for which the weight ratio of Al_2O_3/SiO_2 is 70/30 ~ 74/26, and; needle-punching some of the fiber to orient in the vertical direction in relation to the laminated surface.

[Effects]

According to the present invention, there can be obtained a holder in which fiber deterioration hardly occurs even for a long period of use and which exhibits stable holding ability for a long time.

Claims

[Claim 1]

A holder for an exhaust gas purifying device characterized by a constitution comprised of a blanket made by: laminating alumina fiber, for which the single fiber tensile strength is 150~400kg/mm^2, 5% by weight or less of shot content having a 45μm diameter or greater, and for which the weight ratio of Al_2O_3/SiO_2 is 70/30 ~ 74/26, and; needle-punching some of the fiber to orient in the vertical direction in relation to the laminated surface.

[Claim 2]

A holder for an exhaust gas purifying device as described in Claim 1 in which the crystallinity of the alumina fiber is 0~10%.

[Claim 3]

An internal combustion engine exhaust gas purifying device having the holder, described in Claim 1or 2, placed between a catalyst casing and a honeycomb catalyst housed inside the catalyst casing.

[Detailed Description of the Invention]

[0001] [Industrial Field of Application]

The present invention relates to a catalyst holder used for an internal combustion engine exhaust gas purifying device. Specifically it relates to a holder that holds a honeycomb type catalyst in a catalyst casing.

[0002] [Prior Art]

For removal of nitrogen oxide contained in internal combustion engine exhaust gas, a purifying device, which houses a honeycomb type catalyst in a catalyst casing, is installed in an exhaust gas passage. In automobiles, a muffler is used as a catalyst casing and a ceramic catalyst housed in a catalyst casing in the muffler is used as a purifying device. In order to stably hold this honeycomb type catalyst in a muffler, it is proposed to use, as a holder, a formed object obtained by hardening with an organic binder, etc. ceramic fiber or ceramic fiber in which thermally expandable mineral pieces are dispersed. (Please refer to Tokkai [Publication of Unexamined Patent Application] No. 1-240715).

[0003]

Known ceramic fiber used as such holders are silica fiber, alumina-silica fiber, asbestos fiber, glass fiber, zirconia-silica fiber, etc. In diesel engines, since exhaust gas contains a large quantity of soot, some soot is collected at the muffler and then burned and removed by performing high temperature heat treatment inside the muffler. Because of this, a honeycomb type catalyst and holder are exposed to high temperatures of 800~1000°C. Under such high temperature, fiber becomes brittle caused by formation of crystalline grains and crystal growth, so there was a concern of reduction of holding ability.

[0004] [Problems that the Invention is to Solve]

The purpose of the present invention is to provide a honeycomb catalyst holder in which fiber does not become brittle under high temperature and burning and removal of an organic binder is not troublesome.

[0005] [Means to Solve the Problems]

The present invention is achieved based upon the finding that when a blanket, which is made of mullite composition alumina fiber having great strength and containing a small shot content and for which needle-punching is performed, is used as a holder, it excels in retaining strength and deterioration occurs hardly at all. Describing the present invention in more detail, the holder of the present invention is made of laminates of alumina fiber.

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The fiber length and fiber diameter of alumina fiber that comprises laminates are not specifically limited, but usually the length is 20~200mm and the fiber diameter is 1~40μm, preferably 2~20μm. This fiber must be a mullite composition having a weight ratio of Al_2O_3/SiO_2 (hereafter referred to as " Al_2O_3/SiO_2") of 70/30 ~ 74/26. When Al_2O_3/SiO_2 of alumina fiber is not in the above-described range, fiber deterioration, caused by crystallization and crystal growth at high temperature, occurs prematurely and it does not withstand long usage.

[0006]

The preferable crystallinity of a mullite composition alumina fiber used in the present invention is 0~10%. Here, crystallinity is expressed by a percentage (%) of peak intensity of a mullite composition alumina fiber at $2\theta=26.3°$ in relation to the peak intensity at $2\theta=26.3°$, measured by X-ray diffraction using CuK α-ray, of a completely crystallized mullite, which is sintered at 1300°C for 4 hours. Compared to alumina fiber having other compositions, crystalline grains are hard to be formed for the mullite composition alumina fiber when it is heated at temperature. Especially a low crystalline mullite composition alumina fiber, having crystallinity of 0~10%, has few crystals that become nucleus for crystal growth, so fiber deterioration does not easily occur when it is subjected to 800~1000°C heating.

[0007]

The single fiber tensile strength of alumina fiber used in the present invention is 150~400kg/mm^2. When it is less than 150kg/mm^2, sufficient surface pressure cannot be obtained [for use] as a holder. The greater the single fiber tensile strength, the greater the strength of the holder, so it is preferable, but when it exceeds 400kg/mm^2, fiber lacks flexibility and the holder becomes brittle. Further, the alumina fiber used in the present invention has 5% by weight or less of shot content having a diameter of 45μm or greater. When shot with less than 45μm diameter is present in the holder, it does not have an impact on retaining strength, etc., but for shot with greater than a 45μm diameter, fiber breakage occurs caused by its [shot] becoming a fulcrum and loses retaining strength. When shot content, with 45μm diameter or greater, exceeds 5% by weight, the specific

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gravity of portions of the holder increases, so thermal conductivity becomes uneven, resulting in inability to evenly hold a honeycomb type catalyst.

[0008]

The blanket made by laminating alumina fiber can be produced using a generally known blanket production method. For example, an organic binder, such as: alumina sources, for instance alumina oxychloride, etc.; silica sources, for instance silica sol, etc., or; polyvinyl alcohol, etc., is mixed with water and then spun to obtain an alumina precursor. A sheet made by laminating the alumina precursor is needle-punched and then sintered at 1000~1300°C to obtain the blanket.

[0009]

Some of the alumina fiber precursors in the sheet penetrate through the sheet by needle punching and they are oriented in the vertical direction to tightly bind the sheet, so the sheet bulk density is increased and furthermore, separation of the layers and shifts between the layers can be prevented. The density of needle-punching is usually 1~50 punchings/cm^2. A change in the density of needle-punching enables adjustment of the blanket bulk density and strength. (Please refer to Tokkai No. 62-17060.)

In order to hold a honeycomb type catalyst in a catalyst casing using the holder of the present invention. for example: the holder is tightly wound around the entire honeycomb-type catalyst so as to be an even thickness; placed in a catalyst casing, and; secured by closely attaching to the inner wall of the casing using the retaining strength of the holder.

[0010] [Working Examples]

Next, the present invention is specifically described with reference to the working examples. However, the present invention is not limited to the following working examples so long as the main points are within its scope.

[0010] Working Example 1

In order to examine fiber deterioration for 24 hours heating at 800°C, 25g of a blanket, which has the characteristics described in Table 1, made of fiber with a fiber diameter of about 4μm and containing 4% shot having a 45μm [diameter] or greater, and which was needle-punched, was dispersed in 1.5 liters of water. It was loosened for a specific time using a home use mixer. After it was left for 30 minutes, a sedimentation volume was measured. When fiber deteriorates, fiber breaks, caused by loosening, and become shorter and the sedimentation volume becomes smaller. Thus, comparing the sedimentation volume before and after heat treatment, the degree of deterioration by heat treatment is understood. Results are shown in Table 1.

[0011] Comparative Example 1

The same operation was performed as in Working Example 1 except that a blanket, having the characteristics shown in Table 1, made of fiber having a fiber diameter of about 4μm, and needle-punched, was used. Results are shown in Table 1.

[0012] Comparative Example 2

The same operation was performed as in Working Example 1 except that a blanket, having the characteristics shown in Table 1, made of fiber having a fiber diameter of about 3μm, and needle-punched, was used. Results are shown in Table 1.

[0013] [Table 1]

	Fiber				Heat treatment	Sedimentation volume (cm^2/l)				
	Al_2O_3/ SiO_2	Crystal-linity (%)	Content of shot with 45μm or more	Single fiber strength (kg/mm^2)		Loosening time (sec) 30	60	90	120	150
Working Example 1	72/28	0	4	200	Before	72	64	62	60	54
					After	74	64	68	60	56
Comparative Example 1	95/5	0	2	80	Before	32	19	16	15	14
					After	23	14	9	9	9
2	50/50	0	25	200	Before	64	58	56	54	52
					After	58	48	46	44	38

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[0014]

As evident from Table 1, with fiber whose single fiber tensile strength is less than 150kg/mm^2, the sedimentation volume before the heat treatment is small and fiber tends to be easily broken. Even if the single fiber tensile strength is greater than 150kg/mm^2, when the content of shot having [a diameter] larger than 45μm exceeds 5% by weight, it is evident that breakage after the heat treatment is significant.

[0015] Working Example 2

A rectangular parallelepiped test piece of 50 x 50 (mm) was cut from the blanket that was made of the same fiber as that in Working Example 1, with surface density of 0.160g/cm^2, and with needle-punching. A cycle test was conducted using this test piece to examine change in surface pressure caused by repetitions of high temperature and low temperature, i.e., change in holding ability. The surface density is a value obtained by calculation of density multiplied by thickness. Results are shown in Table 2.

[0016] Cycle Test

1. At room temperature, compress the test piece to 4.6mm in the thickness direction and measure the surface pressure.
2. Next, while expanding the thickness of the test piece to 4.9mm, heat the test piece until the center portion becomes 800°C. When the center portion of the test piece becomes 800°C, measure the surface pressure.
3. While measuring the surface pressure, hold it at 800°C for one hour.
4. Leave it cool while compressing the thickness of the test piece to 4.6mm.
5. 1 through 4 makes up one cycle. Repeat this cycle three times.

[0017] Comparative Example 3

The cycle test was conducted using a formed object containing a mineral that is available in the market as a honeycomb type catalyst holder. This mineral-containing formed object was produced by compressing the thickness of ceramic fiber, having a surface density of 0.278g/cm^2, to about 4mm. Heating burned the organic binder in the formed object and it expanded to about 20mm in the thickness direction to exhibit the holding

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ability. At the room temperature during the first cycle, the formed object was smaller than the clearance; thus no surface pressure was generated. Results are shown in Table 2.

[0018] [Table 2]

	Surface density (g/cm^2)	Temperature/ thickness		Surface pressure (kg/cm^2) 1 cycle	2 cycle	3 cycle
Working Example 2	0.160	Room temp.	/4.6mm	1.88	1.85	1.77
		800°C/	4.9mm	1.29→1.29	1.16→1.16	1.10→1.10
Comparative Example 3	0.278	Room temp.	/4.6mm	------	1.80	1.73
		800°C/	4.9mm	2.56→0.29	0.11→0.00	0.00→0.00

[0019]

In Table 2, the surface pressure values at the left side show the maximum value and those at the right side show [the value] just before the temperature drop. The holder of the present invention exhibited sufficient surface pressure after being subjected to repeated heating and cooling and maintained the holding ability. It was evident that the mineral-containing formed object showed fiber deterioration after repetition of heating and cooling, and after the second and following cycles, it did not exhibit the surface pressure at 800°C and it lost the holding ability.

[0020] Working Example 3

A blanket, that was made of the same fiber as in Working Example 1 and with needle punching performed, was heat treated at 800°C for 24 hours to obtain a blanket having surface density of $0.160 g/cm^2$. From this blanket, a rectangular parallelepiped test piece of 50 x 50 (mm) was cut. It was compressed in the thickness direction at room temperature. The thickness was alternately increased and decreased from 4.6mm to 4.9mm to measure the surface pressure. One increase and decrease was viewed as one set and 10 sets were repeated. Table 3 shows the results.

[0021] Working Example 4

A blanket, having the characteristics show in Table 3, made of fiber having a fiber diameter of 4μm, and with needle punching performed, was heat treated at 800°C for 24

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hours. Except for the use of this blanket, the same operation as in Working Example 3 was performed. Results are shown in Table 3.

[0022] Comparative Example 4

The same operation as in Working Example 3 was performed except for using a blanket, made of the same fiber as Comparative Example 1 and with needle punching performed, and heat treated at 800°C for 24 hours. Results are shown in Table 3.

[0023] Comparative Example 5

The same operation as in Working Example 3 was performed except for using a blanket, made of the same fiber as Comparative Example 2 and with needle-punching performed and heat treated at 800°C for 24 hours. Results are shown in Table 3.

[0024] Comparative Example 6

The same operation as in Working Example 3 was performed except for using the same mineral-containing formed object as Comparative Example 3, heat-treated at 800°C for 24 hours. Results are shown in Table 3.

[0025] [Table 3]

	Al_2O_3/ SiO_2	Crystal-linity (%)	Fiber Content of shot with 45μm or more (wt%)	Single fiber strength (kg/mm2)	Thickness	Surface pressure (kg/cm2) 1	2	3	4	5	6	7	8	9	10
Working Example															
3	72/28	0	4	200	4.6mm	2.92	2.43	2.31	2.27	2.22	2.21	2.16	2.12	2.12	2.07
					4.9mm	1.27	1.18	1.15	1.12	1.09	1.08	1.05	1.04	1.02	1.00
4	72/28	100	4	150	4.6mm	2.10	1.68	1.59	1.53	1.49	1.46	1.44	1.43	1.41	1.39
					4.9mm	0.81	0.75	0.72	0.70	0.68	0.66	0.64	0.67	0.64	0.63
Comparative Example															
4	95/5	0	2	80	4.6mm	1.49	1.23	1.19	1.14	1.11	1.09	1.08	1.06	1.04	1.04
					4.9mm	0.56	0.52	0.49	0.47	0.46	0.45	0.44	0.43	0.42	0.41

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5	50/50	0	25	200	4.6mm	1.39	1.10	1.01	0.98	0.94	0.91	0.88	0.87	0.86	0.85
					4.9mm	0.47	0.41	0.38	0.36	0.36	0.34	0.33	0.32	0.32	0.31
6	Mineral containing formed object				4.6mm	0.61	0.60	0.59	0.59	0.60	0.59	0.58	0.57	0.57	0.58
					4.9mm	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[0026]

From Table 3, blankets, which have a high surface pressure with 4.6mm thickness for the first set and a small reduction in surface pressure after repetitions of increase and decrease of thickness, have high fiber retaining strength and are suitable for the holder.

[0027] [Effects of the Invention]

According to the present invention, there can be obtained a holder in which fiber deterioration hardly occurs after a long period of use and which exhibits stable holding ability for a long time.

10. Related Proceedings Appendix

The opinion in support of the decision being entered today was **not** written for publication and is **not** precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte JOSEPH A. FERNANDO,
JOHN D. TEN EYCK,
and THOMAS S. LACKI

Appeal No. 2005-0979
Application No. 09/560,469

HEARD: June 7, 2005

Before GARRIS, DELMENDO, and PAWLIKOWSKI, **Administrative Patent Judges**.

PAWLIKOWSKI, **Administrative Patent Judge**.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1-27 and 41-44. Claims 28-40, 45, and 46 have been withdrawn from consideration. See brief, page 2.

A copy of claims 1 and 12 are set forth below:

> 1. A device for the treatment of exhaust gases comprising:
>
> a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica, said fibers having been prepared by a process including heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated fibers have about 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å; and

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

12. A device for the treatment of exhaust gases comprising:

a housing having an inlet at one end and an outlet at an opposite end through which exhaust gases flow;

a fragile structure resiliently mounted within said housing, said fragile structure having an outer surface and an inlet end surface at one end in communication with said inlet of said housing and an outlet end surface at an opposite end in communication with said outlet end of said housing;

a support element disposed between the housing and the fragile structure, said support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica, said fibers having been prepared by a process of heat treating said fibers under a time-temperature regimen comprising heat treating said fibers at a temperature of greater than 1050°C for an effective amount of time such that the treated fibers have about 5 to about 50 percent crystallinity as

detected by x-ray diffraction, and a crystallite size of about 50Å to about 500Å;

wherein said support element exerts a minimum residual pressure for holding said fragile structure within said housing of one of at least 4 psi after 200 cycles of testing at 900°C or at least 10 psi after 1000 cycles of testing at 750°C.

On page 4 of the brief, appellants group the claims into two groupings. Group I is directed to claims 1-11, 41, and 42, of which claim 1 is independent. Group II is directed to claims 12-27, 43, and 44, of which claim 12 is independent. We therefore consider claim 1 and claim 12 in this appeal. We note that although appellants discuss claim 4 in the reply brief, this claim is not under consideration in this appeal according to the groupings made by appellants on page 4 of the brief. See 37 CFR § 1.192(c)(7)(2003); see also 37 CFR §41.37 (c)(1)(vii)(effective September 13, 2004; 69 Fed. Reg. 49960 (August 12, 2004); 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)).

Claims 1-27 and 41-44 stand rejected under 35 U.S.C. § 103 as being obvious over Robinson in view of Sasaki, and further in view of Johnson.

We note that the 35 U.S.C. § 112, second paragraph, rejection has been withdrawn by the examiner. Answer, page 2.

The examiner relies upon the following references as evidence of unpatentability:

Robinson et al. (Robinson)	5,580,532	Dec. 03, 1996
Johnson et al. (Johnson) (Great Britain Patent Publication)	1 481 133	Jul. 27, 1977
Sasaki et al. (Sasaki) (Japanese Patent Publication)[1]	JP 07-286514	Oct. 31, 1995

OPINION

We have carefully reviewed appellants' brief and reply brief, and the examiner's answer, and the evidence of record. This review has led us to conclude that the examiner's rejection is well-founded.

I. The 35 U.S.C. § 103 rejection of claims 1-27 and 41-44 as being obvious over Robinson in view of Sasaki and Johnson

We consider claims 1 and 12 in this rejection.

The examiner's position for this rejection is set forth on pages 3-5 of the answer. Appellants respond to this rejection on pages 1-14 of the brief, and also in the reply brief.

Appellants' arguments focus on the particular formation of the "melt-formed" ceramic fibers, used to make support element 20. In this regard, claim 1 recites that the support element comprises a "substantially non-expanding ply of **melt-formed** ceramic fibers containing alumina and silica" [emphasis added], wherein the fibers have "been prepared by a process including heat treating said fibers under time temperature regimen comprising heat treating the fibers at a temperature of 990°C to at least 1050°C for greater than 1 hour such that the treated

[1] We use the English translation of the Sasaki reference.

fibers have about 5 to about 50 percent crystallinity" and "a crystallite size of about 50Å to about 500Å".

Claim 12 recites that the **melt-formed** ceramic fibers are formed by a process comprising "heat treating said fibers at a temperature of greater than 1050°C for an effective amount of time such that the treated fibers have about 5 to about 50 percent crystallinity, and a crystallite size of about 50Å to about 500Å" [emphasis added].

At the bottom of page 7, and at the top of page 8 of appellants' specification, appellants' specification discloses that the support element comprises substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica wherein the fibers have been prepared by a process involving a particular time temperature regimen, as described at the top of page 8 of the specification. On page 14 of the specification, beginning at line 14, the specification discloses that the ceramic fibers are melt-formed ceramic fibers containing alumina and silica, and more preferably, are melt spun refractory ceramic fibers. More particularly, these fibers have been heat treated at temperatures ranging from at least 990°C to about 1400°C, such that the fibers exhibit suitable handling properties and resilience, have at least 5 to about 50 percent crystallinity as detected by x-ray diffraction, and a crystallite size of from about 50Å to about 500Å. At line 26, on page 14 of appellants' specification, the specification discloses that fibers utilized in the plies are melt-formed, preferably spun fibers of high purity chemically.

At the top of page 9 of the brief, appellants state that Sasaki discloses a catalyst holder for an exhaust gas treatment device, and the holder comprises "a blanket of alumina fibers of mullite composition". Our review of Sasaki is discussed below.

We refer to the Abstract, on pages 1-2 of the English translation of Sasaki, which discloses that the blanket is made by laminating alumina fiber, and the weight ratio of Al_2O_3/SiO_2 is 70/30 to 74/26, and needle-punching of some of the fiber is conducted to orient the fiber in the vertical direction in relation to the laminated surface. Also, claim 1 of Sasaki, as set forth on page 2 of the English translation of Sasaki, recites that the holder is comprised of a blanket made by laminating alumina fiber having a weight ratio of Al_2O_3/SiO_2 from 70/30 to 74/26.

In paragraph [006], on page 4 of the English translation of Sasaki, the preferred crystallinity of the mullite composition alumina fiber is from 0 to 10 percent. This falls within the claimed range of the crystallinity recited in appellants' claim 1 and in appellants' claim 12. The mullite composition alumina fiber is sintered at 1300°C for four hours. This time and/or temperature regimen overlaps the time temperature regimen recited in appellants' claim 1 and in appellants' claim 12.

Hence, contrary to appellants' statement made on page 7 of the reply brief (that Sasaki does not teach appellants' claimed time temperature regimen for heat treating), Sasaki does in fact teach the claimed subject matter in this regard.

With regard to appellants' argument that Sasaki's fibers are formed by a sol-gel process, and that this differs from the claimed requirement of "melt-formed" ceramic fibers, we provide the following comments.

In paragraph [008], on page 5 of the English translation of Sasaki, Sasaki discloses that the blanket made by laminating alumina fiber, can be produced using a generally known blanket production method. "For example, an organic binder, such as alumina sources, for instance alumina oxychloride, etc.; silica

sources, for instance silica sol, etc., or; polyvinyl alcohol, etc., is mixed with water and then spun to obtain an alumina precursor".

Although appellants' argue that the "melt-formed" ceramic fibers (which are then subjected to the time/temperature regimen recited in claim 1 and in claim 12), differ from sol-gel fibers, we are not convinced by such argument. That is, the real issue is whether the product (support element or blanket) of a melt formed ceramic fiber, subjected to a particular time-temperature regimen process, is different from the product of a sol-gel ceramic fiber that is subjected to the same time-temperature regimen process. The evidence before us indicates that the resultant product is the same, for the following reasons.

First, as pointed out by the examiner in the paragraph bridging pages 4-5 of the answer, Sasaki discloses a ceramic fiber that is heat treated within appellants' claimed temperature and time range, and thus, the heat treated fiber of Sasaki "inherently possesses the same properties as that of the instant claims".

Furthermore, as discussed above, Sasaki teaches that the blanket has a crystallinity from about 0 to 10 percent, which falls within appellants' claimed crystallinity. Although Sasaki is silent with regard to the crystallite size, we agree with the examiner's inherency theory. We note that it is well settled that "when the claimed and prior art products are identical or substantially identical or are produced by an identical or substantially identical process, the PTO can require an applicant to prove that the prior art does not necessarily or inherently possess the characteristics of his claimed product." In re Best, 652 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977).

Moreover, the argument regarding the manner of formation of the support element raises the issue pertaining to product-by-process limitations. A product-by-process limitation is not a method limitation, but rather a product limitation in which the product is defined, in whole or in part, by the process used to make the product. In *ex parte* proceedings before the PTO, product-by-process claims are interpreted as not being limited by the process steps recited in the claims, because product-by-process claims define a product rather than a process. See In re Thorpe, 777 F.2d 695,697, 227 USPQ 964, 965-66 (Fed. Cir. 1985). It follows, accordingly, that any reference in the prior art to the same, or similar compound, no matter how made, may render the claim anticipated or obvious. Thus, the claim is interpreted as covering the claimed product, no matter how it is made. In the instant case, Sasaki discloses a similar or identical support element, which therefore establishes a prima facie case of obviousness.

Hence, the burden shifts to appellants to show that in fact the blanket (support element) of Sasaki does not achieve the same properties as claimed (including the claimed ability to exert a minimum residual pressure for holding the fragile structure of at least 4 psi after 200 cycles of testing at 900ºC, or at least 10 psi after 1000 cycles of testing at 750ºC).

In this regard, appellants discuss Table I, found on pages 22-23 of their specification, and refer to examples 1-10, and compare these examples with comparative examples A-D. On page 12 of the brief, appellants state that comparative examples C and D were heat treated in accordance with the teachings of Johnson. However, there is no comparative example using the method of Sasaki.

Hence, absent rebuttal evidence in this regard, the examiner's prima facie case of obviousness has not been overcome by the data set forth in appellants' Table I. That is, there is no comparative example that replicates an example from Sasaki regarding the fiber formation and making the blanket, the resultant properties of such a blanket, including testing such a blanket at 900ºC at 200 cycles and then at 1000 cycles at 900ºC.

In view of the above, we therefore affirm the 35 U.S.C. § 103 rejection of claims 1-27 and 41-44 as being obvious over Robinson in view of Sasaki and Johnson. We need not comment on the references of Robinson or Johnson in making this determination.

II. Conclusion

The obviousness rejection is affirmed.

Appeal No. 2005-0979
Application No. 09/560,469

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a)(iv)(effective Sept. 13, 2003; 69 Fed. Reg. 49960 (Aug. 12, 2004); 1286 Off. Gaz. Pat. Office 21 (Sept. 2004)).

AFFIRMED

BRADLEY R. GARRIS Administrative Patent Judge	BOARD OF PATENT APPEALS AND INTERFERENCES
ROMULO H. DELMENDO Administrative Patent Judge	
BEVERLY A. PAWLIKOWSKI Administrative Patent Judge	

BAP/sld

Appeal No. 2005-0?.9
Application No. 09/560,469

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